Variations of coronary arteries in cadavers referred to Tehran forensic medicine organization

Variations of coronary arteries

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Abstract

Aim: Coronary artery disease is the most common cause of death worldwide and is a major cause of hospitalization. The aim of this study was to determine variations in the coronary arteries for use in diagnosis and treatment. Material and Method: In this observational study, we evaluated the data on 1,001 cadavers referred to the Tehran Legal Medicine Organization during 2012. Baseline demographic and anatomical characteristics were collected, and data were analyzed. Results: A total of 1,001 cadavers (206 female and 795 male) aged 40-80 years (mean age = 51, median age = 49) were dissected in this study. All cadavers had two or more coronary artery branches, but the right branch had the most common anatomical dominance pattern; 877 (88%) were right dominant, 94 (9%) were left dominant, and 30 (0.3%) were codominant. The frequency of variations in male was greater than in female, and differences between male and female cadavers were significant for the number of right and left coronary artery branches. Discussion: We found that anatomical diversity of the coronary arteries is more prevalent than in other arteries, and the right coronary artery has the most common anatomical dominance pattern. Moreover, there were no apparent differences from other study findings worldwide.

Introduction

Coronary artery disease (CAD) is the most common cardiac disease. It is the leading cause of' death in the USA in both sexes [1]. Moreover, in 2012, CAD was the most common cause of death worldwide and a major cause of hospital admissions [2].

The first vessels that branch from the aorta are the cardiac arteries, normally below the junction between the aorta and the bulbus, at the sinotubular junction [3]. Coronary arteries normally separate from the sinuses of Valsalva on either side of this point of commissural contact. The coronary arteries and then the right and left coronary arteries divide into other branches that nourish different parts of the heart. Right or left coronary dominance is determined by the posterior descending artery (PDA). PDA branching from the right coronary artery (RCA) determines right dominance, and PDA branching from the left coronary artery (LCA) determines left dominance [Fig 1].
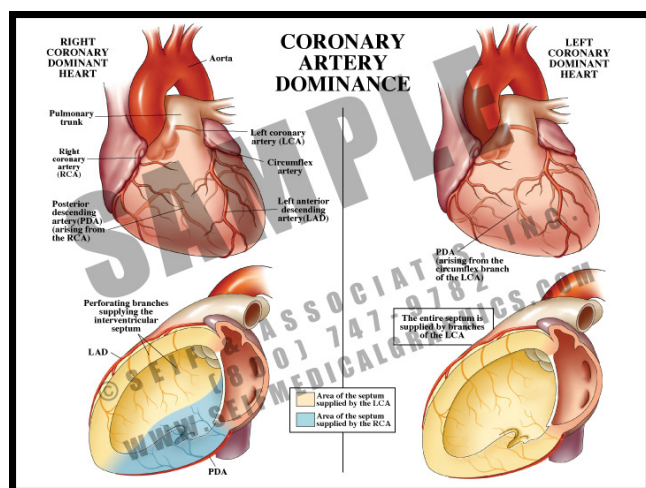

Fig 1.

However, variations in coronary anatomy are common [4]. Variations present in less than 1.0% of the population may be considered abnormalities or anomalies [5]. Both coronary arteries sometimes ramify from a common trunk, their number may increase to 3, or an extra branch is present as the posterior coronary artery. In rare cases, a third coronary may be present [6]. Angelino et al. identified minor anomalies in the branching pattern of coronary arteries and in the site of cusps, and reported anomalies in about 1.0% of the general population [7]. Knowledge about structural variations of the cardiac vessels will improve the quality of treatment.

There are few studies on cardiac vessel variations in the Iranian population. Therefore, we conducted this study to evaluate the structural diversity in Iranians.

Material and Method

This prospective case series study commenced after approval from the Ethics Committee of the Shahid Beheshti University and was conducted on 1,001 cadavers (795 male and 206 female) over the age of 40 years. These were referred to the Autopsy Hall of the Tehran Legal Medicine Organization (LMO) during 2012. A minimum necessary sample size of 868 was calculated using Cohen's formula in order to increase the

validity of the study. In the cadavers, all cardiac arteries had to be available for study. The cardiac arteries were dissected using classic and standard autopsy methods.

Written informed consent was obtained from relatives, who were assured that all findings would remain confidential.

Data were analyzed using SPSS version 21 with descriptive statistical and analytical tests. (chi-square, Fisher's exact test)

Results

A total of 1,001 cadavers, including 206 females and 795 males, aged 40-80 years (mean age = 51, median age = 49) were dissected in this study. Most were in the age range of 45-54 years (61%), followed by 55-64 (30%) and 65-74 (6%),

All cadavers had 2 or more coronary artery branches, but the frequency of LCA branching was significantly (p<0.04) greater than that of the RCA. In the RCA, 889 samples (89%) had 2 branches, 96 (10%) had 3 ranches, and only 16 (2%) had 4 branches; in the LCA, 833 samples (83%) had 2 branches, 148 (15%) had 3 branches, and 20 (2%) had 4 branches.

The frequency of bridging in the LCA was greater than that in the RCA. In the RCA, 989 cadavers (99%) had no bridges, 10 (0.8%) had 1 bridge, and only 2 (0.2%) had 2 bridges. In the LCA, 974 cadavers (97.3%) had no bridges, 25 (2.5%) had 1 bridge, and 2 (0.2%) had 2 bridges. There were no significant differences in the frequency of bridging between LCA and RCA (p>0.23). RCA dominance was the most common pattern: 877 were (88%) right dominant, 94(9%) were left dominant, and 30 (3%) were codominant. There was a significant difference between RCA dominance and LCA dominance (p<0.03). The frequency of variations in male cadavers was greater than that in female cadavers, and the differences in the number of LCA and RCA branches between the male and female cadavers were significant (p<0.04) (Table 1).

Discussion

Variations in the coronary arteries are common in a normal population. Two coronary arteries come off the left side of the heart at the root of the aorta, immediately after the aorta exits the left ventricle.

The LCA originates from the left aortic sinus and the RCA from the right aortic sinus. No artery originates from the posterior aortic sinus [8]. In this study, we evaluated variations in the coronary arteries in cadavers. The frequency of variations was greater in male cadavers than in female cadavers, and the number of branches in the LCA was greater than in the RCA. The frequency of bridging was greater in the LCA than in the RCA. Results show that most people were right dominant (right: 87.6%; left: 9.4%). Our data were consistent with the findings in a report by Erol, in which right dominance was present in 86.6%, left dominance in 9.6%, and codominance in 3.8%. The authors concluded that coronary artery diversity is common [9]. Our findings were also similar to those in a study by Kosar et al., which indicated right dominance in 16.0%. The authors also noted that the left main coronary artery was absent in 0.4% of patients, the circumflex artery and diagonal artery were absent in 0.1%, and myocardial bridging was seen in 37.0% [10]. Right dominance in our study was more common than in the studies by Erol and Kosar. Moreover, right dominance in our

study was more common than in the studies by Abdellah, which reported 77.0% right dominance [11], and Cademartiri et al., which reported 86.6% right overcoming [12]. The reason for the discrepancy is not clear, but may be related to different methods used to evaluate variations. We assessed coronary diversity in cadavers, but the cited studies were based on imaging findings. The most important variation is the pattern of dominance. Right or left coronary dominance is determined by the PDA. PDA branching from the RCA determines right dominance, and PDA branching from the LCA determines left dominance. In left dominance, a large portion of the myocardium is nourished by a single artery (12). In our study, 9.4% of cadavers were left dominant, similar to the findings by Kosar (9.1 %) and Cademartiri (9.2%) [13]. However, our findings were more significant than those of Cademartiri (8.0%) and less significant than those of Fazliogullarl (%14.0) [14].

We noted muscular bridging in both coronary arteries in 39 cases (3.9%), similar to the findings by Nordone et al. (4.0%). This was less than that in a previous study that noted bridging in 10%-37% cases [9, 11]. The differences between our findings and those of Kosar and Cademartiri may relate to the small number of cases in the other studies.

In summary, our findings confirmed that coronary artery variations are common in a normal population and that right dominance is more common.

Our study's limitation was the lack of access to past medical history, including signs or symptoms. Further studies must be performed on variations in coronary arteries to determine the correlations between these variations and sudden cardiac deaths.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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